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(54) **SEWAGE TANKS AND GRINDER PUMP SYSTEMS**

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B65D 90/12	(2006.01)
B65D 21/02	(2006.01)

(52) **U.S. Cl.**

CPC ***B65D 88/76*** (2013.01); ***B65D 90/12*** (2013.01); *B65D 21/0204* (2013.01)

USPC **220/567.1**; 220/634; 206/507

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CPC B65D 88/76; B65D 88/06; B65D 90/12; B65D 21/0204; B65D 21/0201

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IPC B65D 88/76,90/12

See application file for complete search history.

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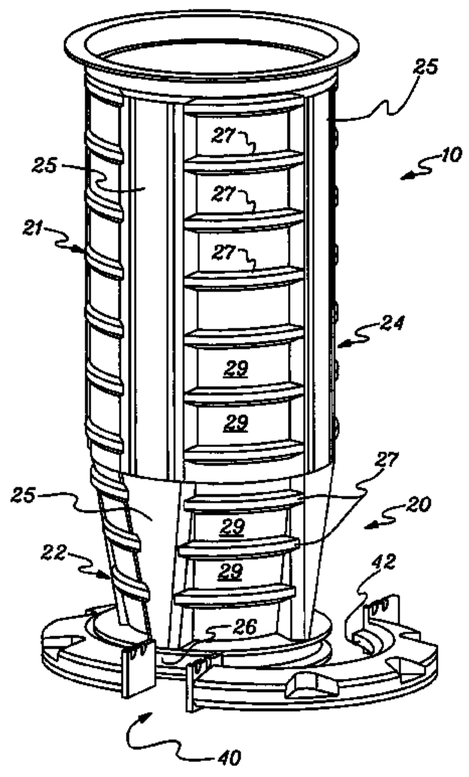
(57) **ABSTRACT**

A sewage tank for use with a pump such as a grinder pump to convey sewage. The sewage tank includes a container comprising a sidewall, and a plurality of members connectable and attachable around an outer surface of the sidewall of the container operable for use in providing additional ballast under high ground water conditions.

34 Claims, 13 Drawing Sheets



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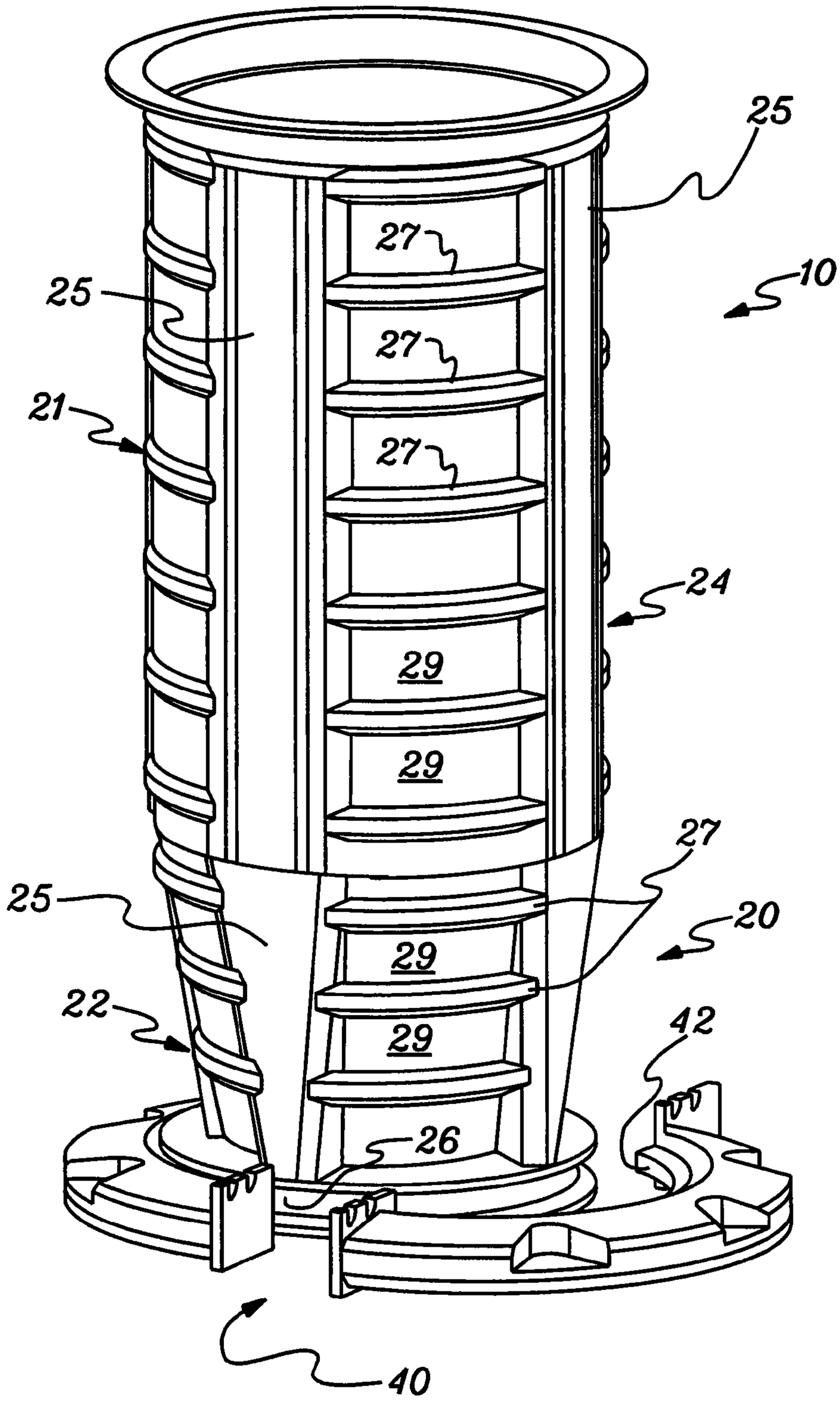


fig. 1

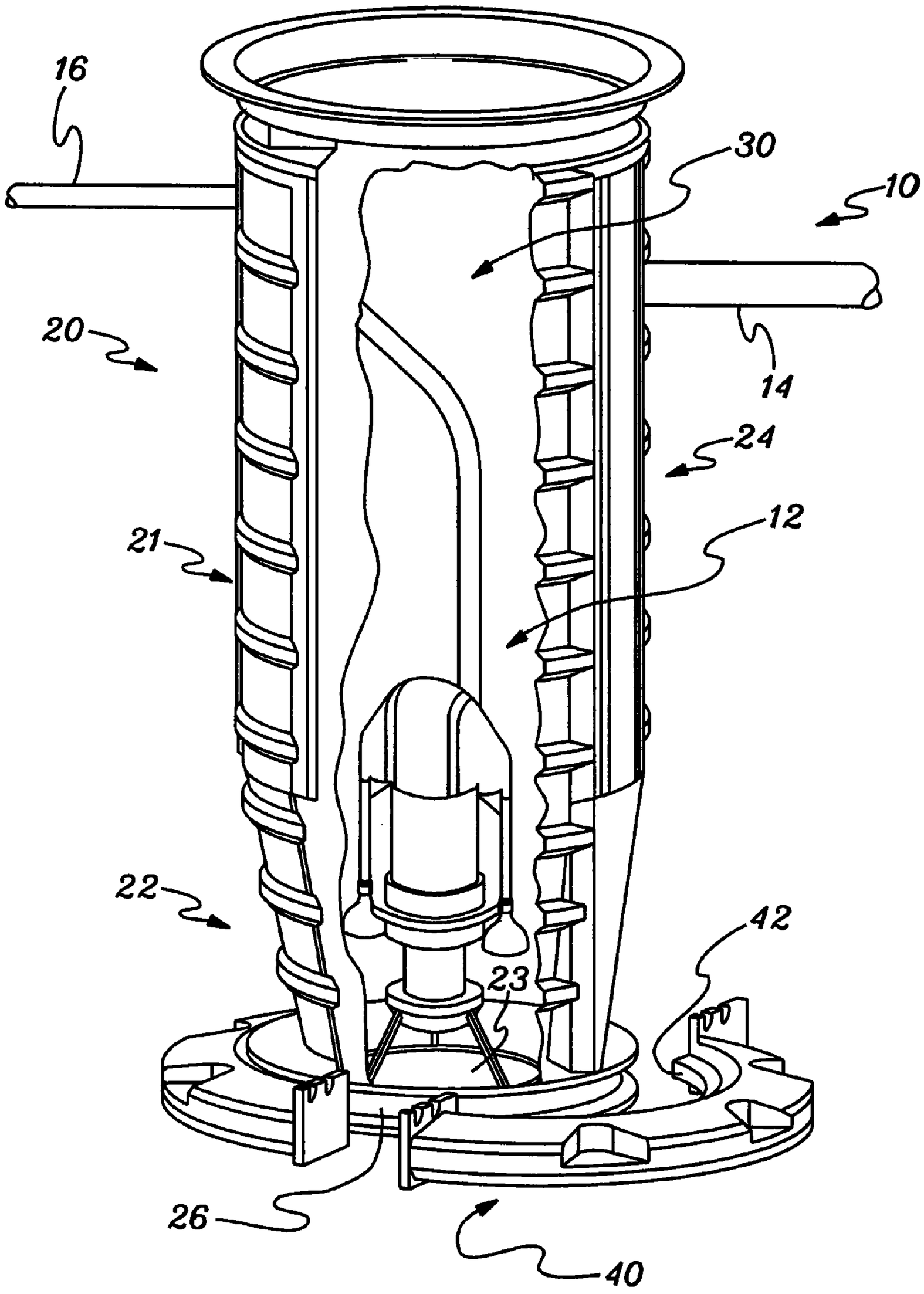


fig. 2

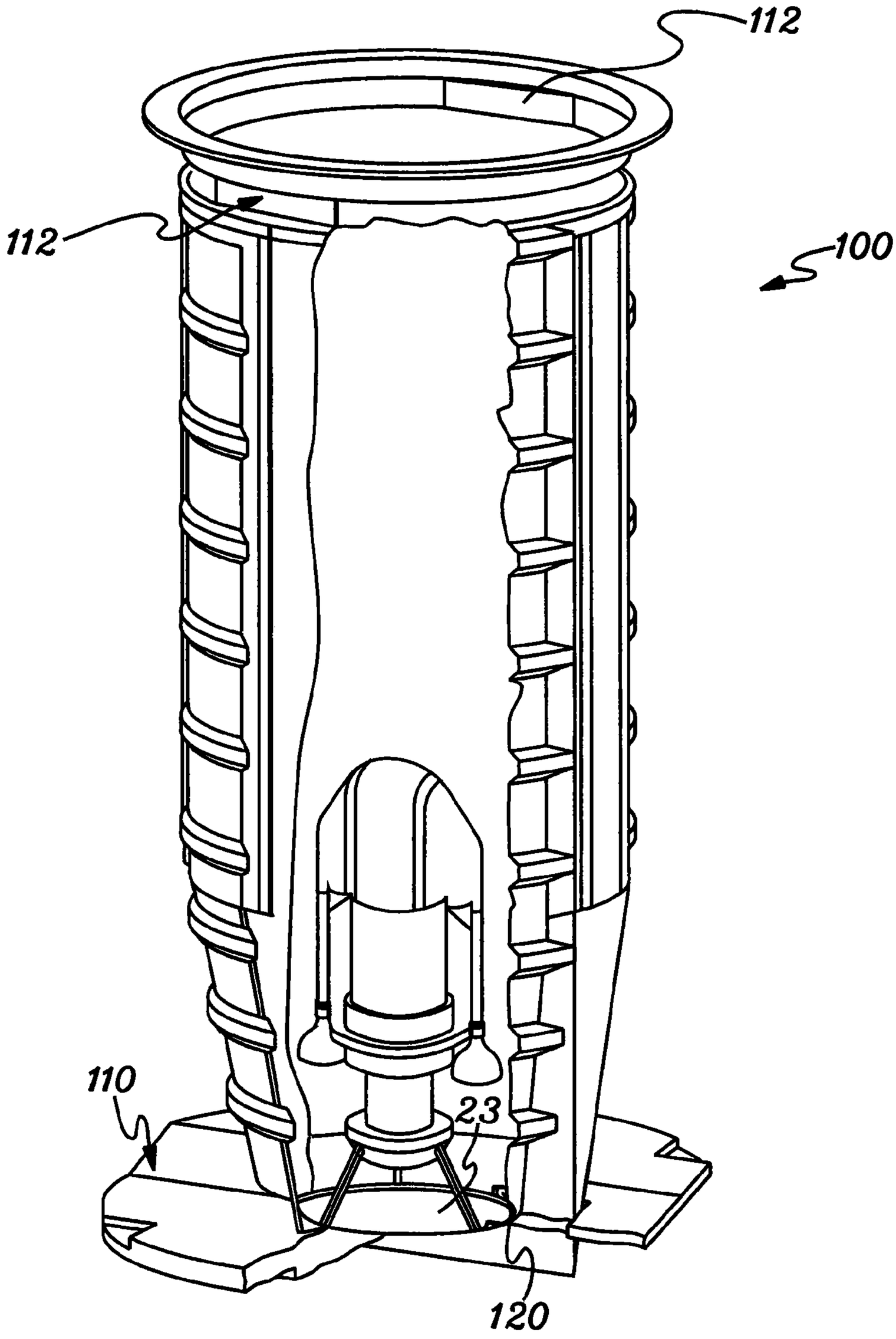


fig. 3

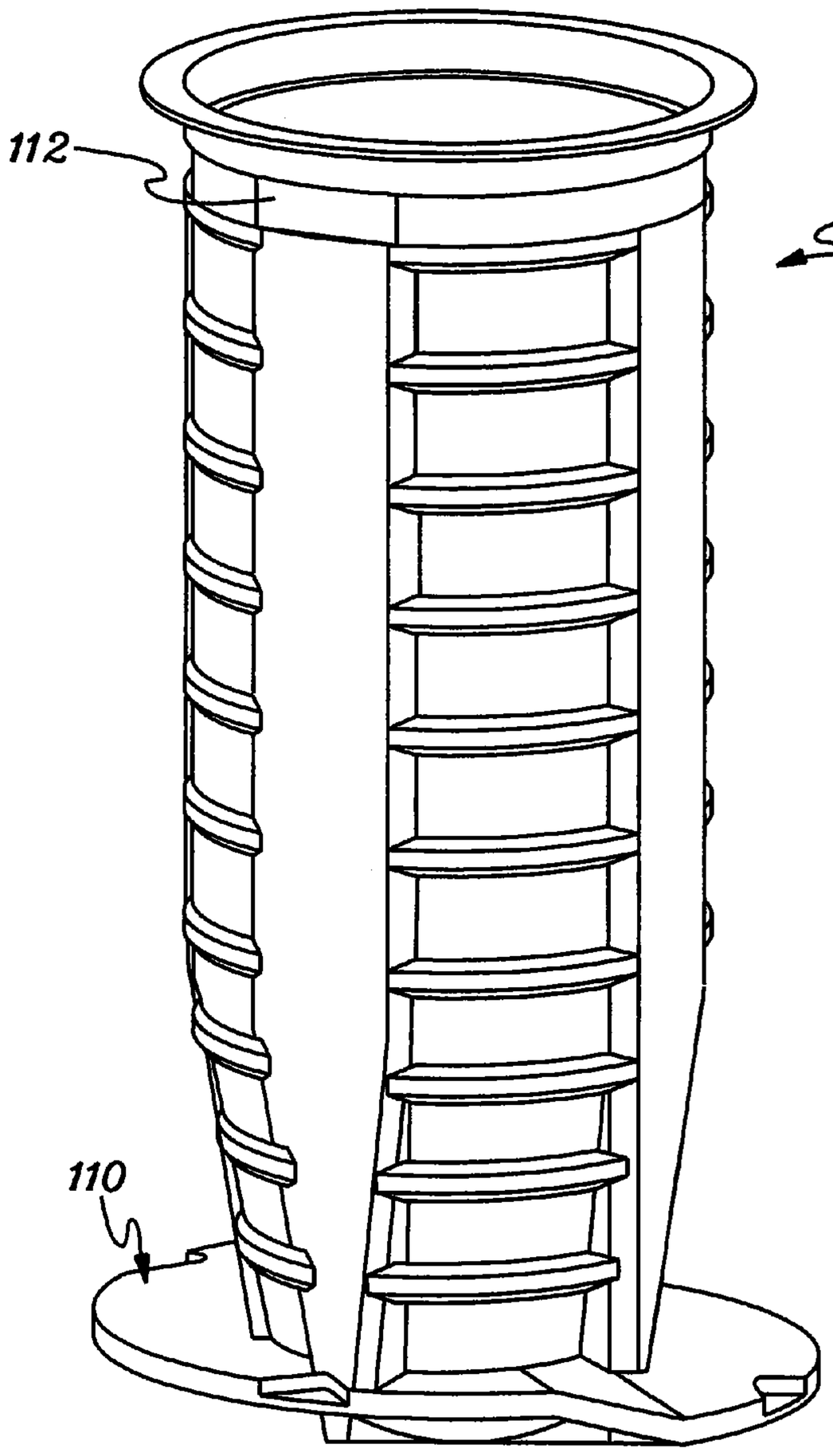


fig. 4

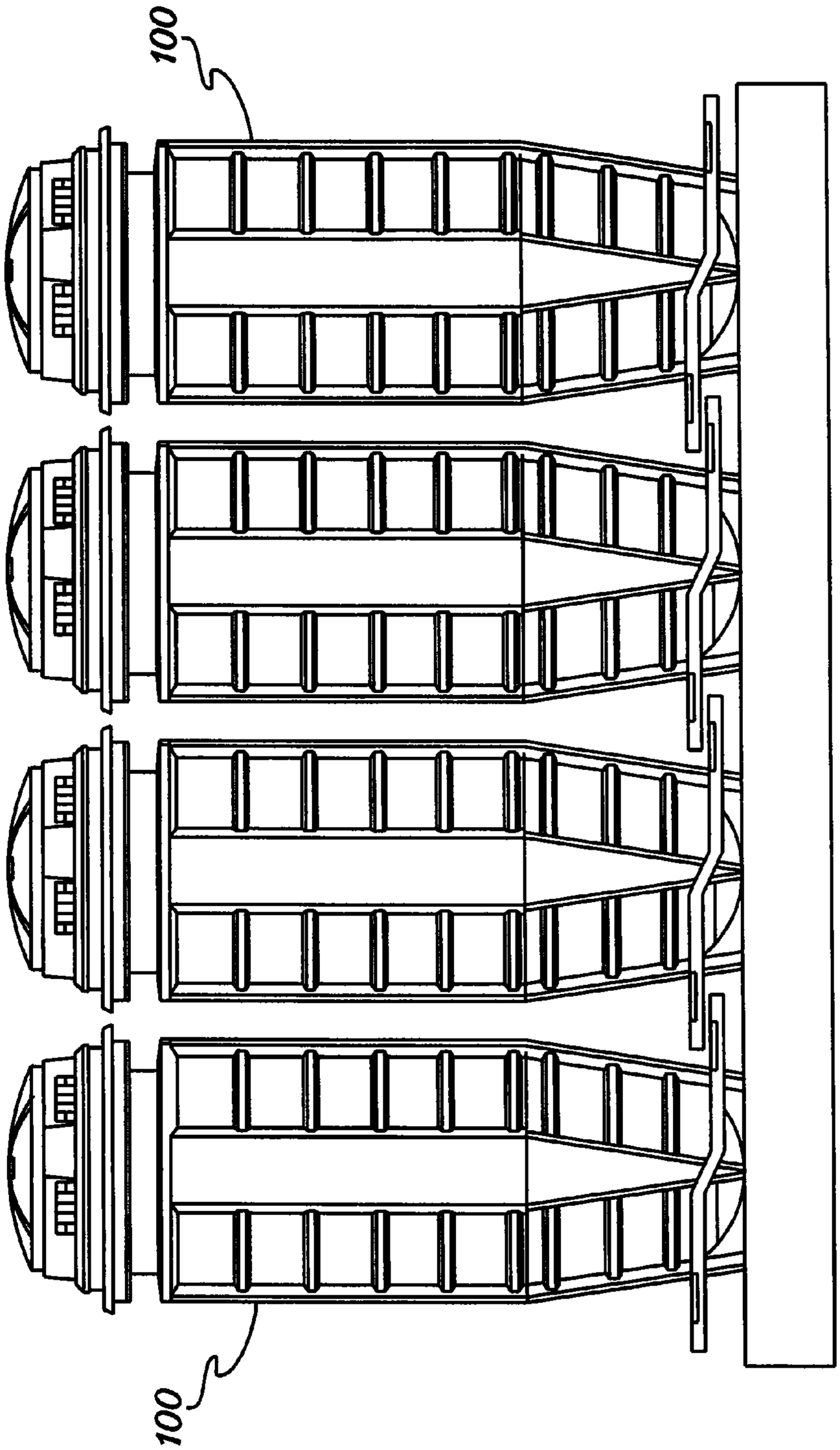


fig. 5

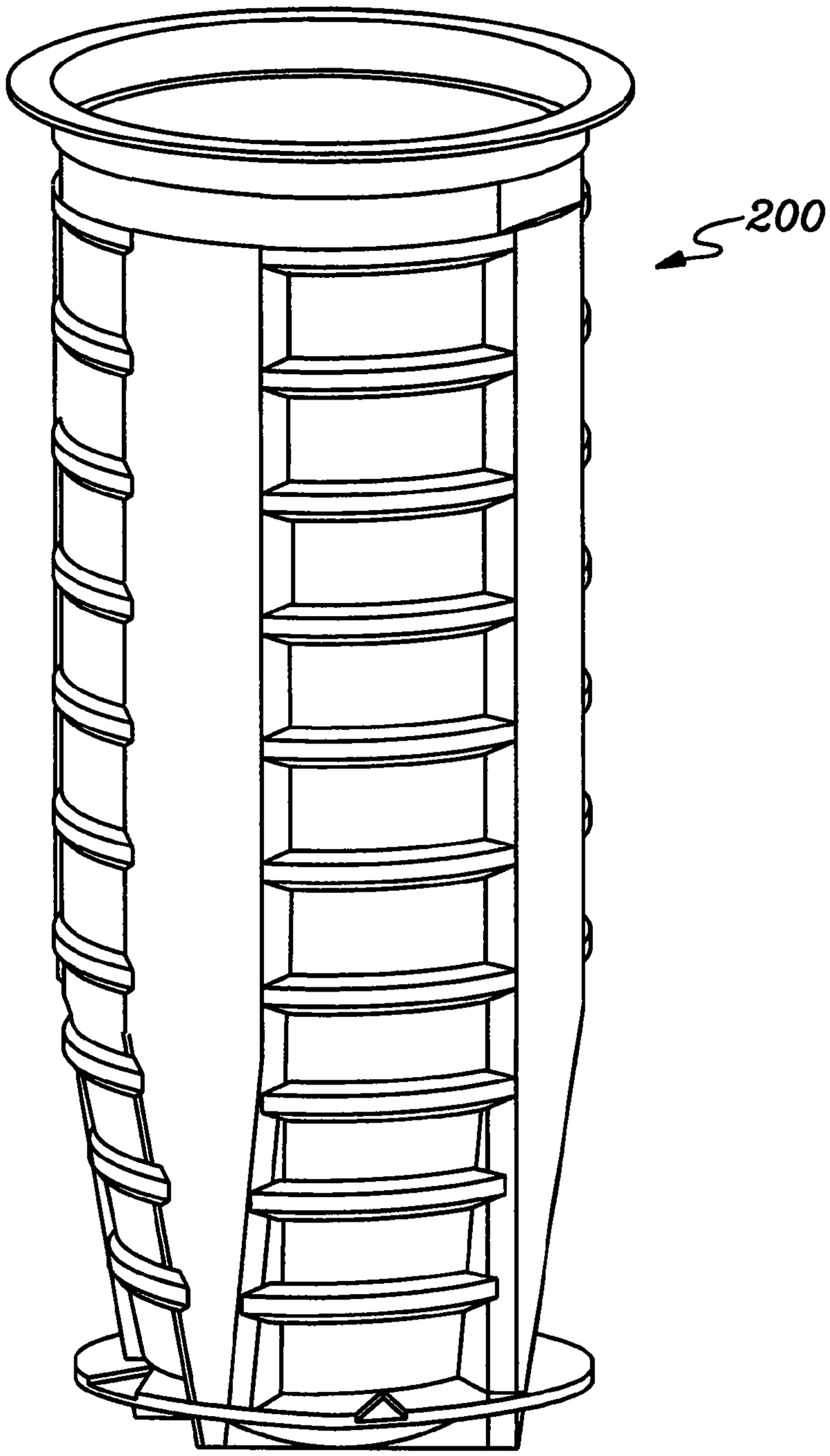


fig. 6

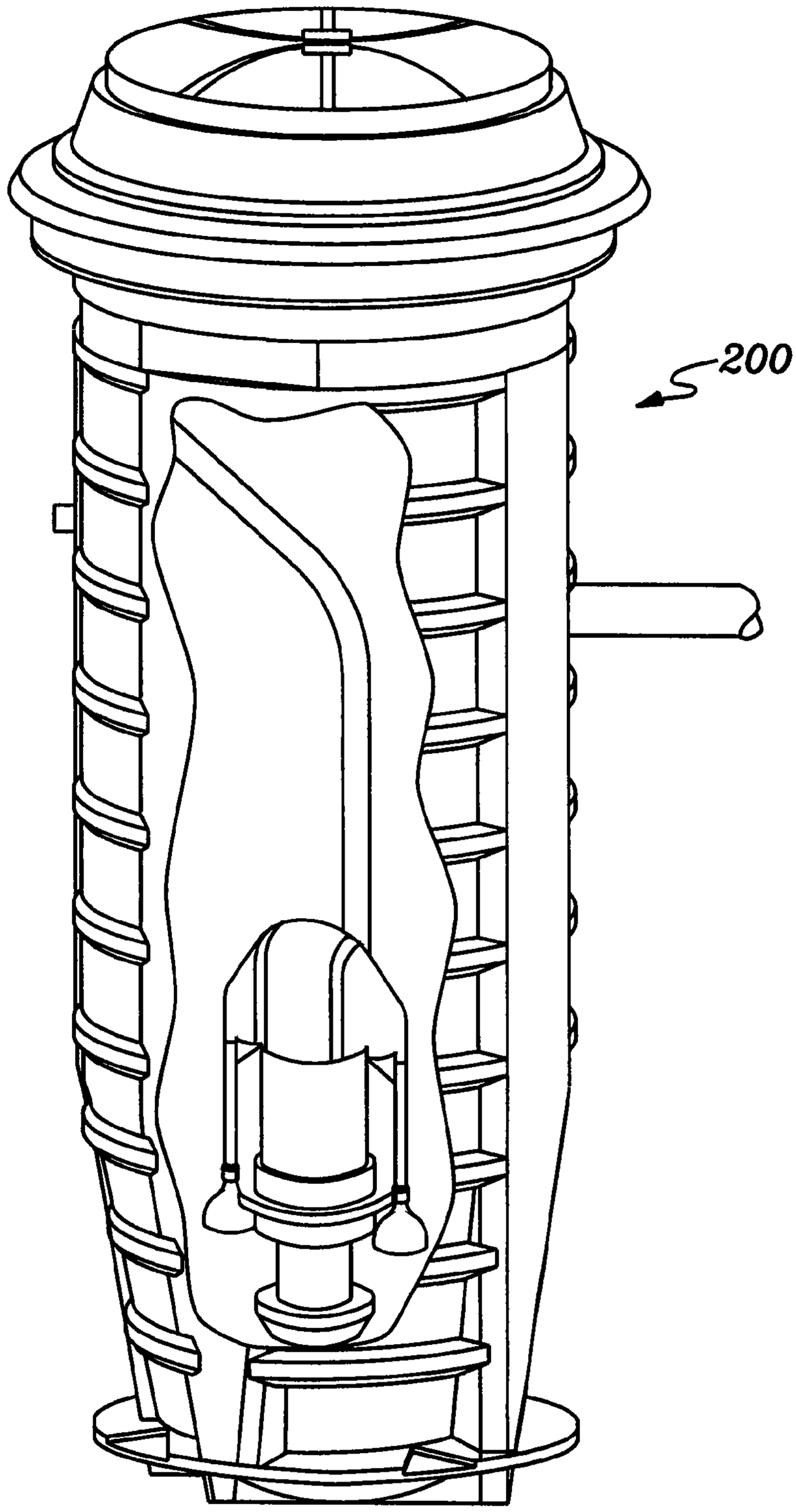


fig. 7

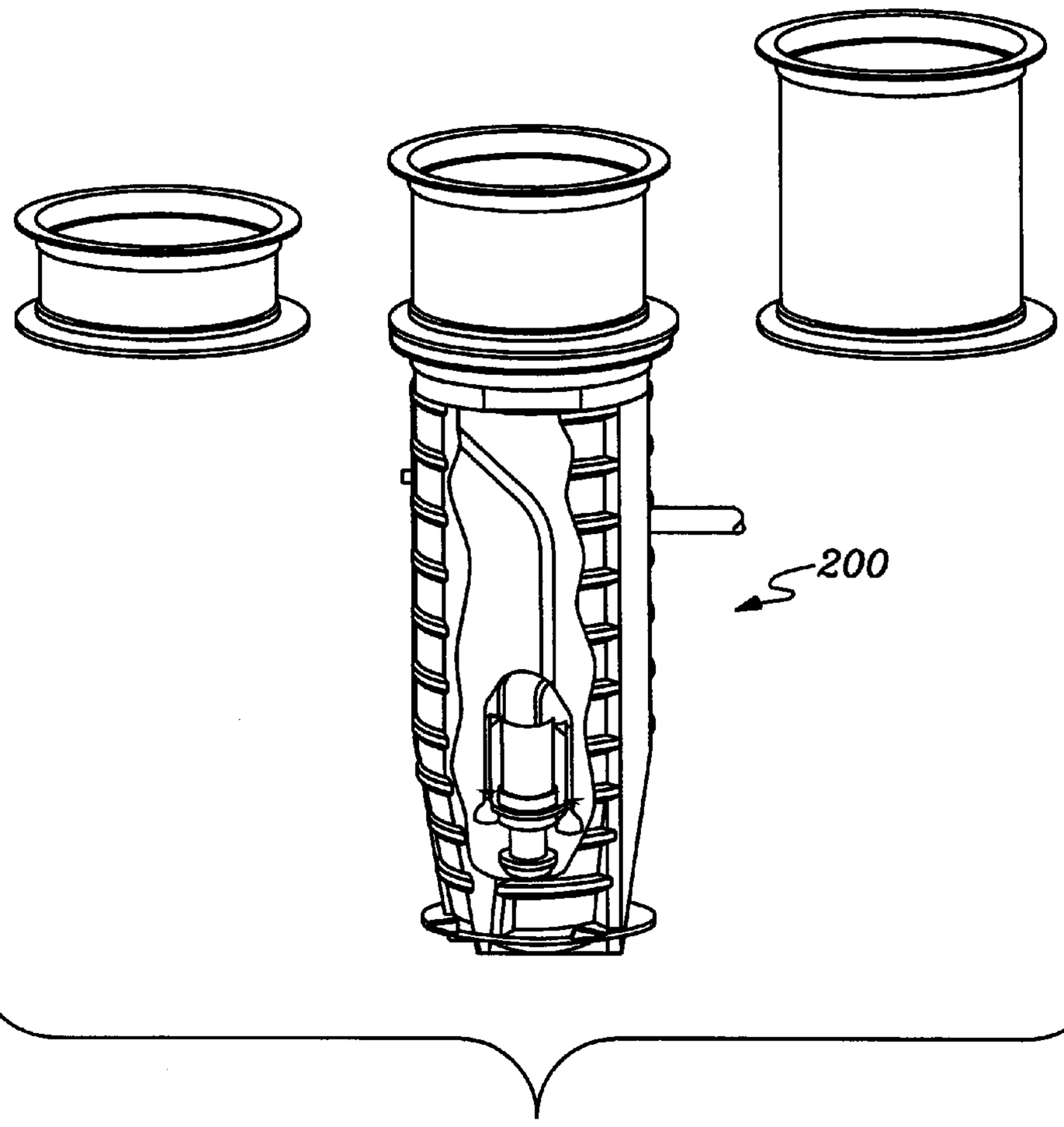


fig. 8

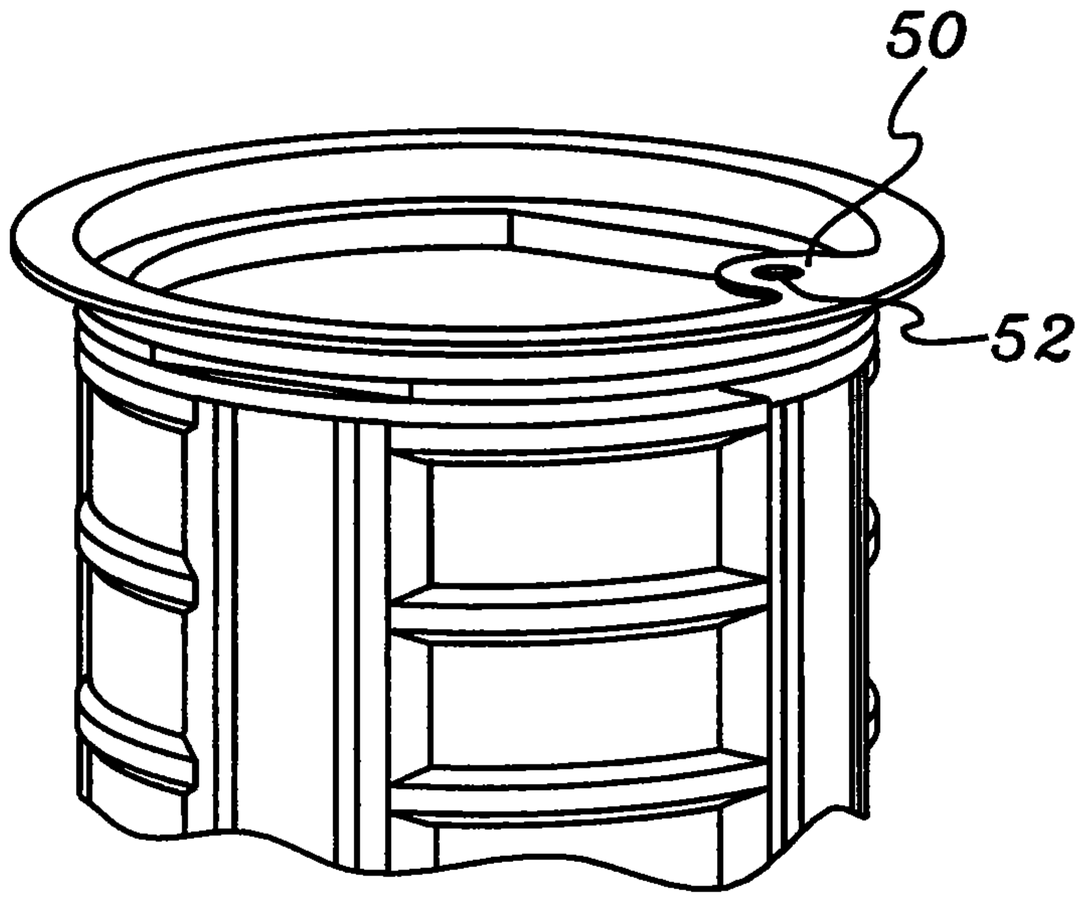


fig. 9

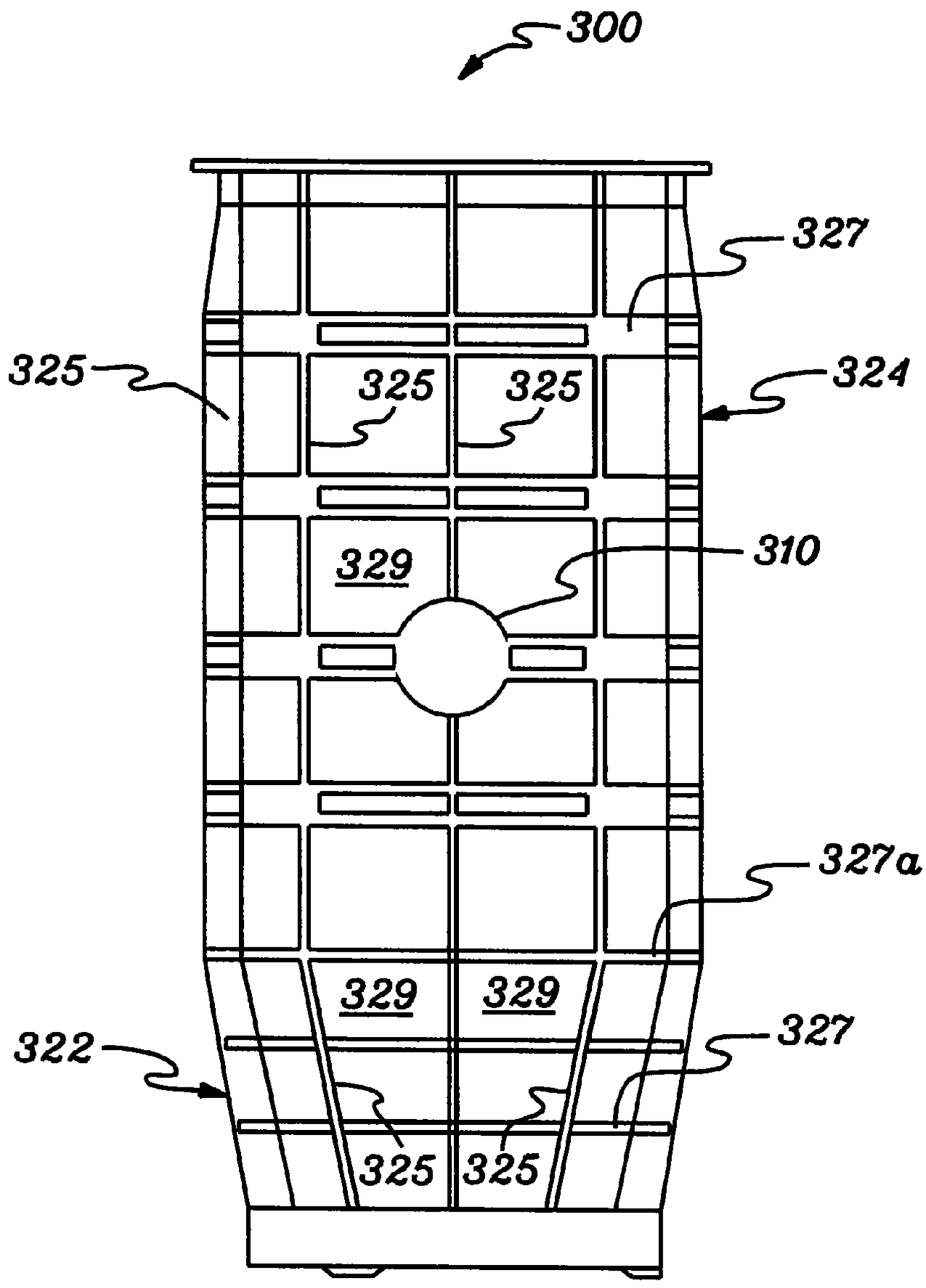


fig. 10

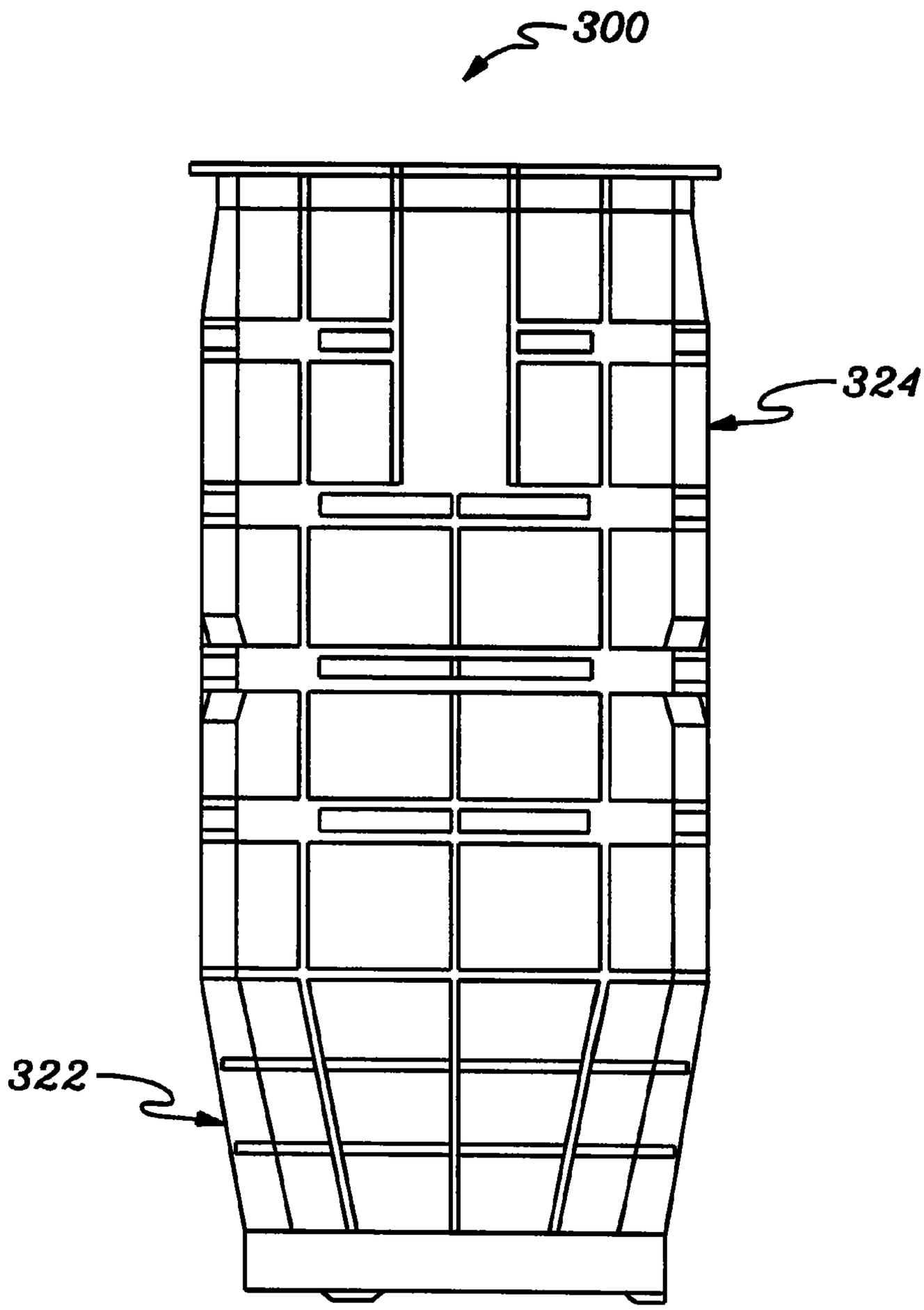


fig. 11

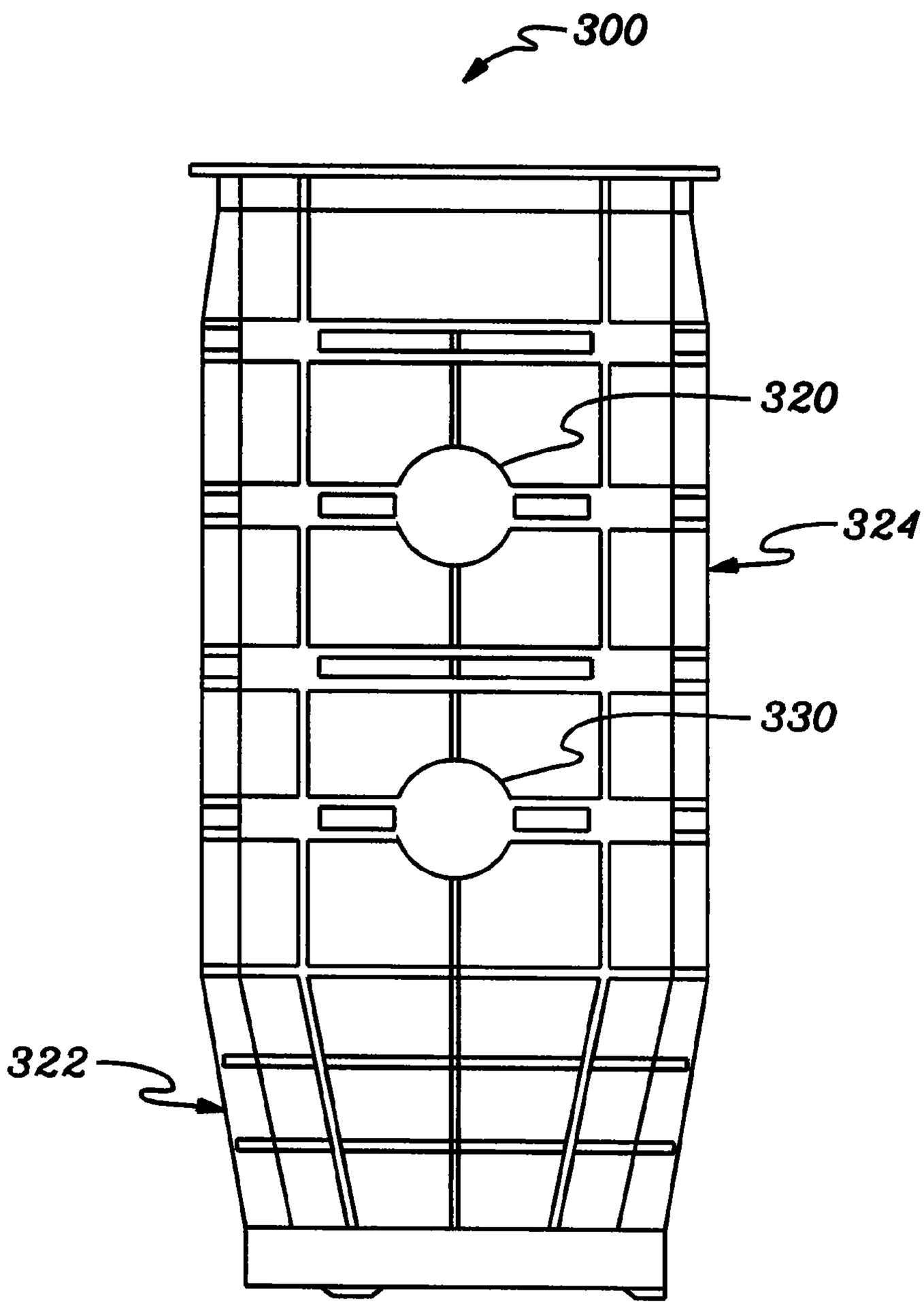


fig. 12

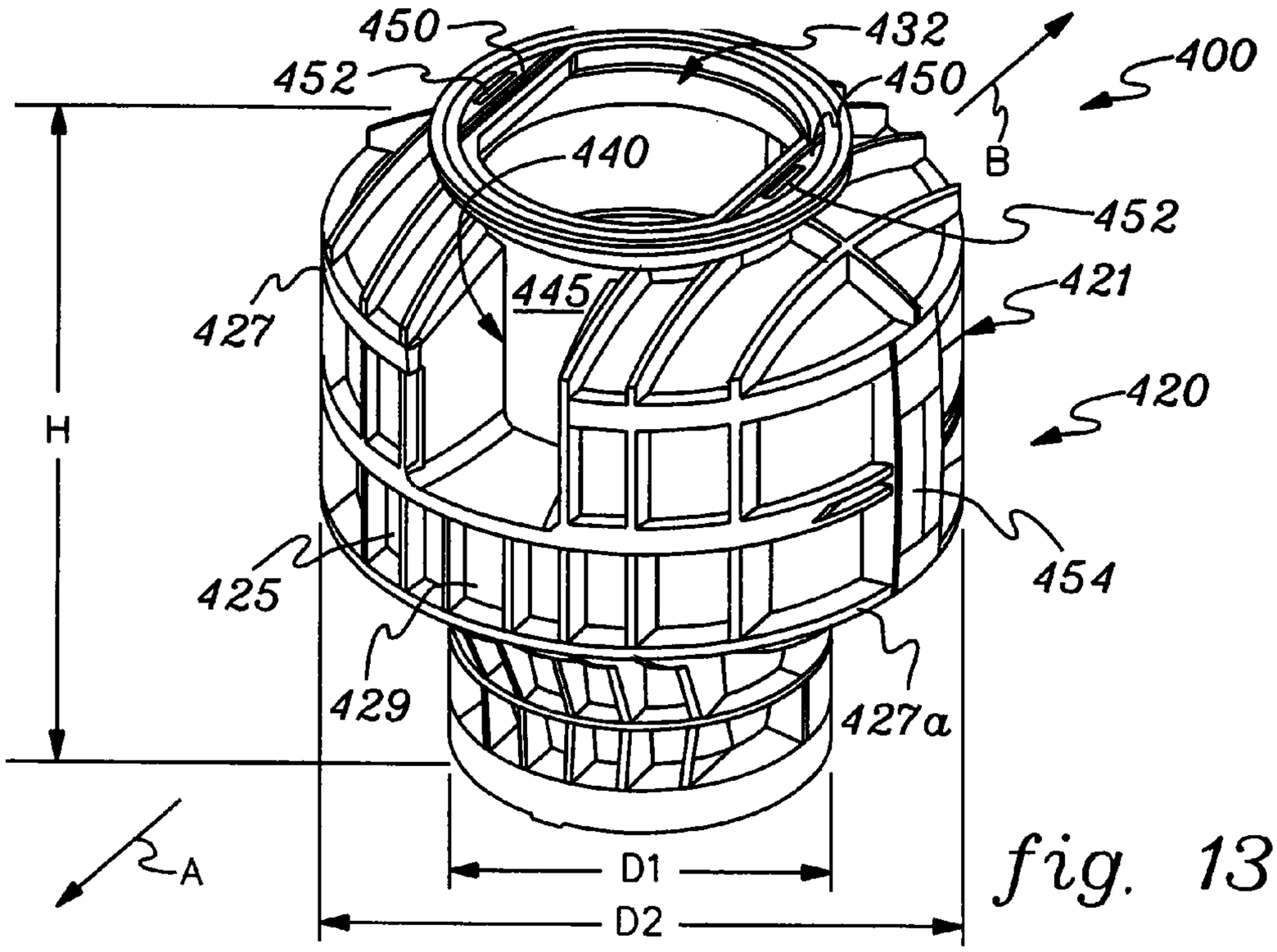
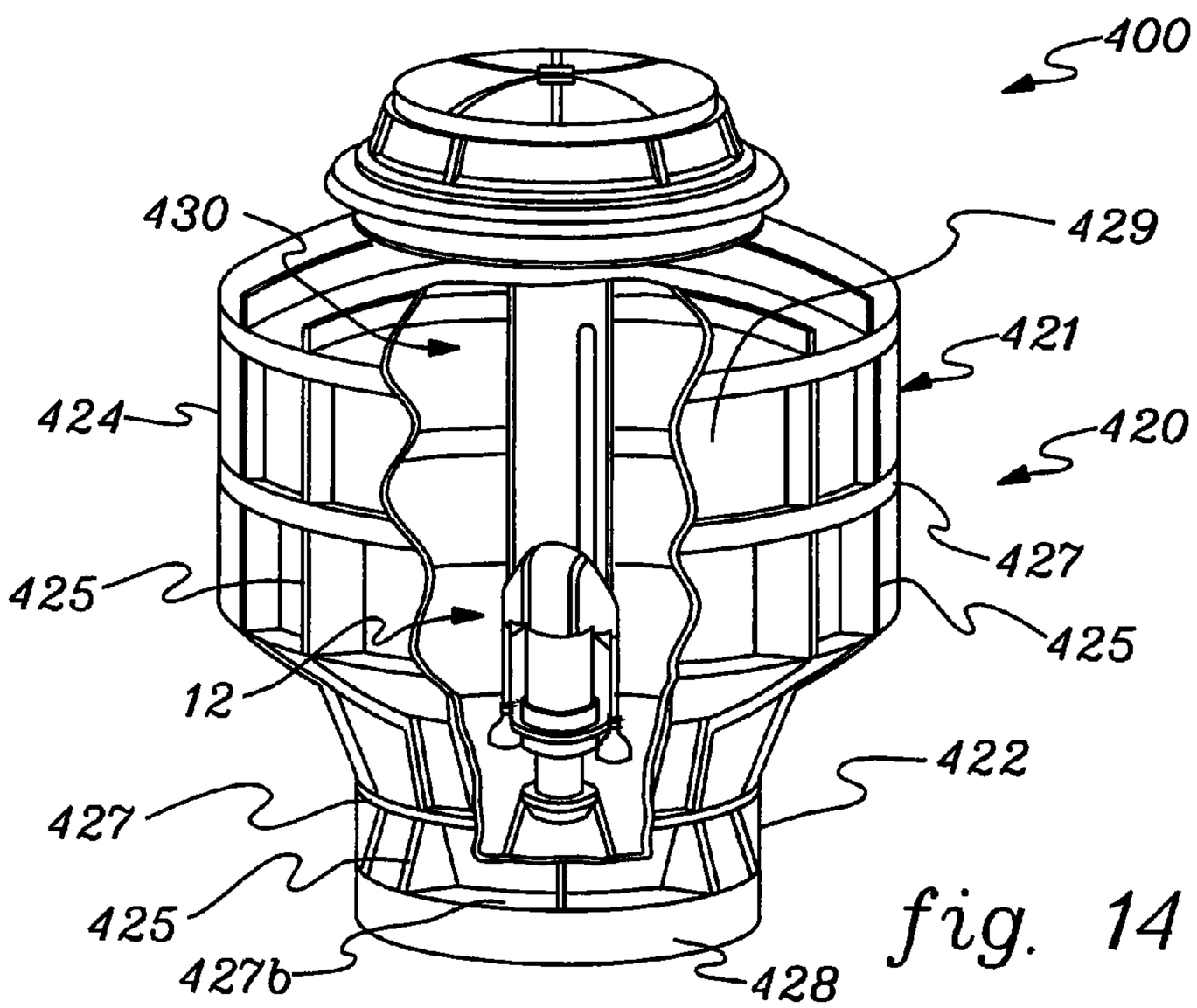

450
452
432
450
400
440
B
452
421
445
427
420
H
454
425
429
427a
A
D1
D2

fig. 13


400
430
429
421
424
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427
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425
12
422
427
425
427b
428

fig. 14

SEWAGE TANKS AND GRINDER PUMP SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 12/621,917, filed Nov. 19, 2009 and entitled "Sewage Tanks And Grinder Pump Systems", which issued on Oct. 30, 2012, as U.S. Pat. No. 8,297,466, which application is a continuation of U.S. patent application Ser. No. 11/337,363, filed Jan. 23, 2006 and entitled "Sewage Tanks And Grinder Pump Systems", which issued on Dec. 1, 2009, as U.S. Pat. No. 7,624,892, which application is a continuation-in-part of PCT patent applications PCT/US2005/027280, filed Aug. 1, 2005, entitled "Sewage Tanks and Grinder Pump Systems," which claims the benefit of U.S. Provisional Application Ser. No. 60/598,231, filed Aug. 2, 2004, the entire subject matter of these applications is incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to sewage tanks, and more particularly, to sewage tanks for use with pumps such as grinder pumps.

BACKGROUND OF THE INVENTION

Grinder pumps are often used in low-pressure sewage systems for pumping sewage. A grinder pump includes a grinder mechanism for cutting or grinding solids or semisolid matter in the sewage being pumped. Grinding solids and/or semisolid matter in the sewage allows the resulting particulate effluent to be transferred using a pump through a small diameter pipe without clogging.

Typically, conventional sewage tanks are installed by digging a hole, placing the tank in the ground, and then pouring concrete around the bottom of the tank. The concrete provides proper ballast to prevent the tank from floating upwardly and popping out of the ground due to its buoyancy under high ground water conditions.

One particular attempt at a sewage tank by Environment One Corporation is the 2000 Series, GP 2012 grinder pump system which includes a generally cylindrical wet well sewage tank portion with a curved top edge and curved bottom edge. A plurality of hollow vertical ribs runs along the length of the tank. A single hollow horizontal rib runs along the middle of the cylindrical portion of the tank. A grinder pump is supported in the tank.

Another attempt at a sewage tank by Environment One Corporation is the 2000 Series, GP 2014 grinder pump system having a wet well sewage tank portion configured with an upper half and a lower half. The lower half is generally cylindrical with a curved bottom edge. A plurality of hollow vertical ribs runs along the length of the lower half. A single hollow horizontal rib runs along the middle cylindrical portion of the lower half. The upper half is generally cylindrical with a curved top edge. A plurality of hollow vertical ribs runs along the length of the upper half. A single hollow horizontal rib runs along the middle cylindrical portion of the upper half. To form the GP 2012 sewage tank, a two-piece mold is used, and to form the GP 2014 sewage tank, a six-piece mold is used.

There is a need for further sewage tanks and pump systems.

SUMMARY OF THE INVENTION

The present invention provides, in a first aspect, a sewage tank for use with a pump to convey sewage. The sewage tank includes a container having an upper portion and a lower tapering portion defining a chamber for containing the pump. The lower tapering portion has a reduced size compared to the upper portion. The upper portion includes a plurality of intersecting vertical ribs and horizontal ribs defining a plurality of recessed pockets, and the lower tapering portion includes a plurality of intersecting vertical ribs and horizontal ribs defining a plurality of recessed pockets.

The present invention provides, in a second aspect, a sewage tank for use with a pump to convey sewage. The sewage tank includes a container having an upper portion and a lower portion defining a chamber for containing the pump. The lower tapering portion has a reduced size compared to the upper portion. The lower portion of the container has an outwardly-extending member. The lower tapering portion of the container and the outwardly-extending member are configured to allow backfilling of the sewage tank so that the backfill provides sufficient ballast under high ground water conditions.

The present invention provides, in a third aspect, a sewage tank for use with a pump to convey sewage. The sewage tank includes a container for containing the pump and an upper portion having an inwardly-extending portion for providing an opening for a vent.

The present invention provides, in a fourth aspect, a pump system which includes the above-described sewage tank and a pump such as a grinder pump disposable in the sewage tank.

The present invention provides, in a fifth aspect, a method for installing a sewage tank. The method includes providing a sewage tank having a lower tapering portion and an outwardly-extending member, and backfilling around the lower tapering portion of the sewage tank.

BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter which is regarded as the invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention, however, may best be understood by reference to the following detailed description of various embodiments and accompanying drawings in which:

FIG. **1** is a perspective view of one embodiment of a grinder pump system in accordance with the present invention;

FIG. **2** is a perspective view, partially cutaway, of the grinder pump system of FIG. **1**;

FIG. **3** is a perspective view, partially cutaway, of another embodiment of a grinder pump system in accordance with the present invention;

FIG. **4** is a perspective view of the sewage tank of FIG. **3**;

FIG. **5** is a side elevational view of a plurality of grinder pump systems of FIG. **3** nested together for shipping;

FIG. **6** is a perspective view of another embodiment of a grinder pump system in accordance with the present invention;

FIG. **7** is a perspective view, partially cutaway, of the grinder pump system of FIG. **6**;

FIG. **8** is a front elevational view, partially cut away, of the grinder pump system of FIG. **7** along with a plurality of access ways;

FIG. **9** is a perspective view of one embodiment of a top of a sewage tank having an inwardly-extending member for providing a vent in accordance with the present invention;

FIG. **10** is a front elevational view of another embodiment of a grinder pump system in accordance with the present invention;

FIG. **11** is a left side elevational view of the grinder pump system of FIG. **10**;

FIG. **12** is a right side elevational view of the grinder pump system of FIG. **10**;

FIG. **13** is a perspective view of another embodiment of a sewage tank in the form of a squat tank in accordance with the present invention; and

FIG. **14** is a front elevational view, partially cutaway, of the sewage tank of FIG. **13** illustrating a grinder pump contained therein.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1** and **2** illustrate one embodiment of a low-pressure grinder pump wastewater disposal system **10** in accordance with the present invention for collecting, grinding, and pumping wastewater. System **10** generally includes a sewage tank **20** and a grinder pump **12** (FIG. **2**).

System **10** is readily installable in the ground by connecting the system to a wastewater feed pipe **14** (FIG. **2**), a wastewater discharge pipe **16** (FIG. **2**), and an electrical power supply (not shown). The system may also be connected to or include a vent (not shown). The exemplary wastewater disposal system provides a convenient, self-contained unit. In addition, the exemplary system is readily accessible and serviceable by a technician or a repairperson.

Sewage tank **20** includes a container **21** having a lower portion **22** and an upper portion **24** which together define a chamber **30** (FIG. **2**) therein for receiving wastewater, for example, from a building. In one aspect, the upper portion may have a generally constant cross-section, e.g., generally cylindrical, and the lower portion has a tapering cross-section to reduce the volume of retained sewage. The upper portion and the lower portion may include a plurality of intersecting vertical ribs **25** and horizontal ribs **27** defining a plurality of recessed pockets **29**. The vertical ribs may extend along the length of the tank, and the horizontal ribs may extend around the tank. The plurality of vertical ribs and horizontal ribs may be hollow and open to the inside of the container. The plurality of vertical ribs, the plurality of horizontal ribs, and the plurality of recessed pockets are configured to provide an opening for installation of at least one of an inlet, an outlet, and a vent. The plurality of ribs aid in strengthening the upper and lower portions of the tank. The ribs and pockets may be sized to provide an inlet, an outlet, or a vent at continuous selectable vertical elevations along the upper portion of the container. As best shown in FIG. **2**, the bottom of the sewage tank may include a concave bottom **23**.

Another aspect of the present invention is the elimination of conventional concrete ballast thereby eliminating the need and labor associated with pouring concrete around the bottom of the sewage tank in the ground to prevent the sewage tank from floating upward due to its buoyancy under high ground water conditions.

As shown in FIGS. **1** and **2**, sewage tank **20** may include a two-piece ring or flange **40** that may be connectable to the bottom of the tank. Flange **40** increases the footprint of the sewage tank (e.g., extends laterally outward from the sidewall) so that the soil above the flange acts as a ballast preventing the sewage tank from floating upwardly and popping out of the ground during high ground water conditions. The flanges may include bolt-on flanges, snap-on flanges, or other suitably connectable flanges. The flange may be provided with an inwardly-extending tongue **42** that is received in a groove **26** extending around the bottom of the sewage tank. In addition, the sewage tank without the flange may allow conventional installation with concrete. For example, the concrete can grab on or secure to groove **26** on the bottom of the sewage tank.

The size of the flange may be determined based on the displaced volume of the soil and/or the volume of the sewage tank in order to provide suitable ballast under high ground water conditions. In one embodiment, a sewage tank about 95 inches high (with access way extension) and about 29 inches wide may include a flange having an outer circular edge with a diameter of about 40 inches.

The bottom portion of the sewage tank may be tapered so that when the pump shuts off the sewage remaining in the bottom of the sewage tank is reduced compared to a tank having a constant cross-section from top to bottom. Desirably, the taper is, e.g. about 10 degrees, thereby making it relatively easy to backfill and compact the backfill during installation. The diameter of the flange may be greater than the diameter of the cylindrical upper portion. Desirably, the radial distance of the flange under the upper portion is equal to the radial distance of the flange that extends beyond the upper portion.

FIGS. **3** and **4** illustrate another embodiment of a sewage tank **100** in accordance with the present invention (generally similar to sewage tank **20**) which includes an integrally formed stepped ballast ring **110** that extends around the bottom of the sewage tank and which is sized to eliminate the need for installing a concrete ballast. In addition, the stepped configuration allows a plurality of sewage tanks to be nested together for shipment as best shown in FIG. **5**. For example, on one side of the sewage tank, a portion of the flange is disposed at a different vertical height than an opposite portion of the flange. The lower and higher portions of the flange allow a plurality of sewage tanks to be compactly arranged as shown in FIG. **5** to optimize shipping.

Another feature is that the top may incorporate two flats **112** on the side of the tank so that a forklift truck can readily grab the tank and so that the need to bolt the tank to a traditional pallet is eliminated. The forklift truck may engage the top of the tank by either of two directions and reduce the effort required in loading and unloading the tank.

In addition, upwardly-extending protrusions or stops **120** (FIG. **3**) may be molded into the inner bottom surface for receiving and retaining the stand for supporting the grinder pump in the center of the tank. For example, four protrusions may be provided.

FIGS. **6-8** illustrate another embodiment for a sewage tank **200** in accordance with the present invention which is generally similar to sewage tank **20** and which includes the sewage tank having a relatively large diameter flange formed integral with the tank. The flange is desirably sized large enough to provide suitable ballast to keep the sewage tank from floating without the need for concrete. It is also noted that the flange may be employed to anchor the sewage tank in a concrete ballast.

The various tanks may incorporate a series of four vertical ribs. The vertical areas are designed so that an opening may be cut along the vertical area for receiving a feed wastewater pipe. A grommet may be placed in the opening for receiving and sealing around the inlet pipe. Similarly, an opening may be cut along a vertical area through which a discharge pipe may pass. In addition, an opening may be cut along the vertical area through which a vent may pass. The feed wastewater pipe, discharge pipe, and vent may also pass through the horizontal ribs or pockets between the ribs.

The top may also be set up to receive an access way extension (e.g., as shown in FIG. **8**) so that the height of the sewage tank could be increased in various increments. In addition, the sewage tank may include a releasably sealable cap having a vent opening as shown in FIG. **7**.

During fabrication of the tank, a top may be integrally formed with the sidewall and bottom. The top can then be cut out, e.g., trimmed to provide an opening to the tank, during installation. Desirably, the top or cover may be either isolated or contain a vent tab allowing either internally venting through a cover system or laterally through the sidewall. FIG. **9** illustrates a top having inwardly-extending portion **50** forming a kidney-shaped cutout in the top. The inwardly-extending portion may include a vent opening **52**.

FIGS. **10-12** illustrate another embodiment for a sewage tank **300** in accordance with the present invention which is generally similar to sewage tank **20**. Sewage tank **300** includes a container having a lower portion **322** and an upper portion **324** which together define a chamber. In one aspect, the upper portion has a generally constant cross-section, e.g., generally cylindrical, and the lower portion has a tapering cross-section to reduce the volume of retained sewage. The upper portion and the lower portion may include a plurality of intersecting vertical ribs **325** and horizontal ribs **327** defining a plurality of recessed pockets **329**. Horizontal rib **327***a* straddles both the upper portion and the lower portion. A plurality of raised pads **310**, **320**, and **330** may be provided for use in providing an opening for an inlet for a feed wastewater pipe or discharge pipe. The location of the pads may be staggered along the length of the upper portions of the tank. The pads, ribs, and pockets allow providing an opening for installation of at least one of a feed wastewater pipe and a discharge pipe at continuous selectable elevations along the upper portion of the sewage tank. In addition, some of the plurality of vertical and horizontal ribs may be solid ribs.

FIGS. **13** and **14** illustrate another embodiment of a low-pressure grinder pump wastewater disposal system **400** in accordance with the present invention for collecting, grinding, and pumping wastewater. System **400** generally includes a sewage tank **420**, generally in the form of a bulbous or squat tank configuration, and a grinder pump **12** (FIG. **4**).

System **400** is readily installable in the ground by connecting the system to a wastewater feed pipe, a wastewater discharge pipe, and an electrical power supply. The system may also be connected to or include a vent. The exemplary wastewater disposal system provides a convenient, self-contained unit. In addition, the exemplary system is readily accessible and serviceable by a technician or a repairperson.

Sewage tank **420**, generally in the form of a squat tank, includes a container **421** having a lower tapering portion **422** and an upper portion **424** which together define a chamber **430** therein for receiving wastewater, for example, from a building. In this illustrated embodiment, upper portion **424** generally has a diameter D**2**, and lower portion **422** generally has a diameter D**1** so that diameter D**2** is greater than diameter D**1**. A height H of the tank may be about equal to diameter D**2**. The height of the tank and the diameter of the upper portion may be between about 50 inches to about 55 inches. The diameter of the lower portion may be about 30 inches.

In addition, upper portion **424** and lower portion **422** may include a plurality of vertical ribs **425** and intersecting horizontal ribs **427** defining a plurality of recessed pockets **429**. A horizontal rib **427***a* straddles the upper and lower portions. A horizontal rib **427***b* may include an apron **428**. The ribs may be hollow or solid. In addition, upper portion **424** may include a recessed portion **440** having a vertical wall **445** configured to provide an opening for installation of at least one of an outlet and/or a vent. The vertical wall **445** is easily accessed from the top of the sewage tank. An elongated rib or pad **454** allows a variable location for providing an opening for an inlet. The upper portion of the tank may have a tapering portion which defines an access opening **432**. The upper portion (as well as the lower tapering portion) may be curved for added strength. Piping through the vertical wall **445** disposed adjacent to the access opening can be readily accessed by a workman through the access opening. Additional recessed portions may also be provided. The bottom of the sewage tank may include a concave bottom.

The top of sewage tank **420** may be integrally formed with the sidewall and bottom. The top can then be cut out, e.g., trimmed to provide an opening to the tank, during installation. Desirably, the top or cover may be either isolated or contain one or more vent tabs allowing either internally venting through a cover system or laterally through the sidewall. As shown in FIG. **13**, the top includes inwardly-extending portions **450**, each having a vent opening **452**.

The grinder pump for use in the various systems may include a grinder mechanism for pulverizing solids or semi-solid matter in the wastewater, a pump assembly attached to the grinder mechanism for pumping ground wastewater through the grinder pump, and a motor. For example, a grinder mechanism may include a stationary outer ring and a rotating cutting blade, and a pump assembly may include a progressing cavity pump having a pump housing, a pump stator, and a pump rotor. It will be appreciated by those skill in the art that other suitable grinder pumps, grinding mechanisms and pump assemblies may be employed.

A motor housing casting houses the electric motor for powering both the grinder mechanism and the pump assembly. As noted above, the housing is preferably attached to a support that sits on the bottom of the sewage tank.

As noted above, the grinder pump is connected to wastewater discharge pipe. In operation, wastewater is drawn into grinder mechanism for cutting or grinding of the solids or semisolid matter in the wastewater. The resulting processed particulate effluent passes through pump assembly and then through the wastewater discharge pipe. The processed wastewater may travel to a remote location, e.g., to a pressure sewage main and ultimately to a sewage treatment plant.

The grinder pump may include one or more sensing tubes to sense pressure variations for measuring the level of wastewater collected in tank. A processor and/or a mechanical-electrical relay are desirably operable, upon the wastewater reaching a predetermined wastewater level, to energize the motor within the motor housing casting.

The various sewage tanks may be rotational molded and formed from high-density polyethylene. A mold may be set up so that a sewage tank may be formed for use with a detachable flange or with a relatively small integral flange for use with concrete or a relatively larger flange so that concrete is not required.

In addition, the plurality of vertical ribs and the plurality of horizontal ribs on one side of the container may be aligned in one direction, and the plurality of vertical ribs and the plurality of horizontal ribs on the other side of the container may be aligned in the opposite direction. Such a configuration of ribs is best illustrated in FIG. **13**, with the ribs on the front aligned in a first direction shown by arrow A and the ribs on the rear aligned in an opposite direction shown by arrow B.

This configuration of ribs allows the forming of the tank using a two-piece mold, e.g., a front half mold and a rear half mold, for forming the sides. A top mold may be used for forming the top of the sewage tank and a bottom mold may be used for forming the bottom of the tank. The two molds for the sides may have cutouts (the reverse of the ribs shown in FIGS. **9**, **13** and **14**) for forming the plurality of intersecting vertical ribs and horizontal ribs. In particular, the cutouts in one of the side molds may be aligned in one direction and the cutouts in the other of the side molds may be aligned in the opposite

direction. The cutouts being aligned in the direction of draw allows for pulling the mold halves apart after forming the tank therein. It is noted that where the two mold halves meet, a vertical rib may be formed therebetween.

While some of the sewage tanks of the present invention are illustrated as having a constant tapering lower portion, it is appreciated that the tapered portions may be curved or have other reduced-size configurations compared to the upper portion.

For the embodiments of the sewage tank where the flange is not needed or where concrete is required, installation may include digging a hole, placing the sewage tank in the ground, and then pouring concrete down in the bottom of the hole.

While various embodiments of the present invention have been illustrated and described, it will be appreciated by those skilled in the art that many further changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

The invention claimed is:

1. A sewage tank for use with a pump to convey sewage, said sewage tank comprising:

a container comprising a sidewall and a bottom; and

a plurality of members connectable and attachable around an outer surface of said sidewall of said container operable for use in providing additional ballast under high ground water conditions.

2. The sewage tank of claim **1** wherein said plurality of members comprises generally the same sized and configured members.

3. The sewage tank of claim **1** wherein said plurality of members comprises ends which are connectable together.

4. The sewage tank of claim **3** wherein said ends of said plurality of members are connectable to each other with at least one bolt.

5. The sewage tank of claim **1** wherein said plurality of members and said sidewall of said container comprise interlocking portions.

6. The sewage tank of claim **5** wherein said plurality of members and said container comprise interlocking tongue and groove.

7. The sewage tank of claim **1** wherein said plurality of members is configured for backfilling of material on top of said plurality of members for providing additional ballast under high ground water conditions.

8. The sewage tank of claim **1** wherein said sidewall and said bottom are integrally formed.

9. The sewage tank of claim **8** wherein said plurality of members is generally connectable and attachable adjacent to said bottom.

10. The sewage tank of claim **1** wherein said plurality of members comprises an outwardly extending flange.

11. The sewage tank of claim **1** wherein said plurality of members comprises a plurality of arcuate-shaped members connectable and attachable around a generally circumferentially-extending surface of said container.

12. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members comprises generally the same sized and configured arcuate-shaped members.

13. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members comprises ends which are connectable together.

14. The sewage tank of claim **13** wherein said ends of said plurality of arcuate-shaped members are connectable to each other with at least one bolt.

15. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members and said sidewall of said container comprise interlocking portions.

16. The sewage tank of claim **15** wherein said plurality of arcuate-shaped members and said container comprise interlocking tongue and groove.

17. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members is configured for backfilling of material on top of said plurality of arcuate-shaped members for providing additional ballast under high ground water conditions.

18. The sewage tank of claim **11** wherein said sidewall and said bottom are integrally formed.

19. The sewage tank of claim **18** wherein said plurality of arcuate-shaped members is generally connectable adjacent to said bottom.

20. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members comprises an outwardly extending flange.

21. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members comprises a pair of arcuate-shaped members.

22. The sewage tank of claim **11** wherein said plurality of arcuate-shaped members are generally connectable and attachable adjacent to said bottom, said plurality of arcuate-shaped members comprising generally the same sized and configured arcuate-shaped members, and wherein said plurality of arcuate-shaped members comprises ends which are connectable together.

23. The sewage tank of claim **22** wherein said plurality of arcuate-shaped members and said container comprise interlocking portions.

24. The sewage tank of claim **23** wherein said plurality of arcuate-shaped members and said container comprise interlocking tongue and groove.

25. The sewage tank of claim **24** wherein said plurality of arcuate-shaped members is configured for backfilling of material on top of said plurality of arcuate-shaped members for providing additional ballast under high ground water conditions.

26. The sewage tank of claim **25** wherein said sidewall and said bottom are integrally formed.

27. The sewage tank of claim **26** wherein said plurality of arcuate-shaped members comprises an outwardly extending flange.

28. The sewage tank of claim **27** wherein said plurality of arcuate-shaped members comprises a pair of arcuate-shaped members.

29. A pump system comprising:

a sewage tank of claim **1**; and

a pump disposable in said sewage tank.

30. The pump system of claim **29** wherein said pump comprises a grinder pump.

31. A pump system comprising:

a sewage tank of claim **11**; and

a pump disposable in said sewage tank.

32. The pump system of claim **31** wherein said pump comprises a grinder pump.

33. A pump system comprising:

a sewage tank of claim **22**; and

a pump disposable in said sewage tank.

34. The pump system of claim **33** wherein said pump comprises a grinder pump.

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